Application/Control No.: 10/519,954
Examiner: SINGH, ARTI R

REMARKS

In part 3 of the Office Action, claims 1 and 4-27 were rejected under 35 U.S.C.§103(a) as being unpatentable over Fuchs et al. (Fuchs) in view of Cordova et al. (Cordova) further in view of GB 2 349 798 (Plant) or Schuster (U.S. 5,854,143)..

Reconsideration is requested.

Claim 1 has been amended to include the substance of canceled claims 4, 5, and 6. The present invention, as defined by amended claim 1 and the claims that are dependent on claim 1, provides an anti-penetration, flexible ballistic composite material comprising ballistic fibers where at least a portion of the ballistic fibers are impregnated or wetted with a polymer in the form of a viscous or visco-elastic liquid having non-Newtonian flow properties and a specifies a dynamic viscosity, a molecular weight, a kinematic viscosity and a Tg. The Examiner has agreed that Fuchs does not disclose a polymer in the form of a thixotropic fluid as pointed out in claim 9 but it is important to note that Fuchs does not even disclose the concept of using a liquid component in a ballistic composite material.

Claim 1 points out that the ballistic composite of the invention has a component which is a polymer in the form of a viscous or visco-elastic liquid having non-Newtonian behavior and a dissipative Modulus (G") that is greater as compared to an elastic component (G') and that the polymer remains in the liquid form maintains its capacity of dissipating energy along the wetted ballistic fibers on a ballistic event. These particular properties are not disclosed as being properties that are possessed by the fabric or film elements of the Fuchs patent. Nothing in Fuchs suggests that the film component is a viscous or visco-elastic liquid.

The improvement in the anti-ballistic behavior of the composite of claim 1 is achieved without impairing the flexibility of the material. These features are particularly applicable to body armor, which needs to be highly resistant to penetration but flexible enough to permit a full range of movement.

The Fuchs, stab resistant, composite material is based on at least two woven fabrics that are joined together with a discrete layer of a polymer film to form a laminate. Fuchs does not teach or suggest the use of impregnated or wetted fibers that are made using a viscous or visco-elastic liquid. Fuchs mentions the use of polymer films which are laminated between woven fabric layers. These structures are exemplified by a polycarbonate polymer which is a solid polymer and not a liquid or visco-elastic polymer. Process claims 25-27 are also not made obvious by Fuchs because Fuchs does not disclose the making of an anti-penetration composite that is made using a liquid that is applied to ballistic fibers.

The Examiner has urged that the structure disclosed by Fuchs would inherently have polymer film with a layer of fabric on each side. This laminate structure would not inherently have a viscous or visco-elastic liquid as required by claim 1 of the present application. Nothing in the structural elements described by Fuchs explicitly or inherently discloses or suggests the concept of using a liquid element as defined by amended claim 1.

Fuchs describes the making of a laminate by pressing a film between two layers of woven ballistic fabric. This does not result in the impregnation or wetting of the woven fiber because the Fuchs process does not use liquid polymers but relies upon pressing two layers of aramid fabrics onto a layer of polycarbonate (Lexan) at a pressure of 10 bar and at a temperature of 220-230°C as described at pages 5 and 6 of the Fuchs patent. The melting point of Lexan is 440°C and aramid does not melt. Thus the product produced by Fuchs would not inherently have the impregnated or wetted fibers as defined by claim 1 because the conditions employed by Fuchs would not produce a liquid that would be viscous or a visco-elastic material in the final product. The Tg of the PVC and polycarbonate films that are used by Fuchs are respectively 80° and 140°C. The polyurethane is a solid and the G' and G" of polyurethane can not be measured at room temperature. Amended Claim 1 points out that the liquid polymer has a glass transition temperature at less than 0°C which characterizes a

material not contemplated by Fuchs. Support for this amendment is found on page 12, line 7.

Cordova discloses an armor system having a first layer of a cut resistant fibrous layer and a second layer of a pliable, impact/ballistic energy absorbing fibrous layer. The Cordova patent does not disclose a structure which is impregnated or wetted with a polymer in the form of a viscous or visco-elastic liquid polymer. The polymers cited by Cordova at col. 11, lines 64-67 and col. 12, lines 1-19 are not disclosed as liquid polymers and no information is given which would suggest that they are liquid polymers.

Schuster discloses a material for antiballistic protective clothing which is described as being a flat structure wherein one or more layers of the anti-ballistic package comprise a flat inflexible structure that has been saturated or charged with organic dilatancy agents. The Tg of less than 0°C of amended claim 1 is much lower than the Tg of the polymer and copolymers disclosed by Schuster at col. 2, lines 57-65. These Tg's range from 25°C to about 130°C and do not suggest the use of a viscous or visco-elastic liquid as defined in amended claim 1. The dilatancy agent may be a solid organic compound applied in the form of a dispersion to the flat structure (col. 3, lines 42-55). The liquid polymers as defined in claim 1 are not mentioned or suggested by Schuster. There is no mention of the use of a thixotropic polymer as pointed out in claim 9. The structure thus made is placed as an insert in a jacket or other structure. The making of a composite material which is arranged on overlying layers using fibers which are impregnated or wetted with a liquid polymer is not taught by Schuster.

Plant discloses a protective member comprising an envelope encapsulating an energy absorbing material which remains soft and flexible until it is subjected to an impact. The preferred embodiment of the Plant patent is Dow Product 3179 which is a siloxane that is reacted with boric acid and is also known as silly putty. This material has a viscosity of 50,000 Pa s which is higher that the upper viscosity level of 25,000 Pa s which is specified in amended claim 1. The Plant invention requires the use of an

envelope which confines the energy absorbing material and prevents egress thereof (page 3, line 4). The Plant reference does not teach the impregnation of ballistic fibers with a polymer in the form of a viscous or visco-elastic liquid as pointed out in amended claim 1. In addition, Plant does not mention the use of a thixotropic liquid as pointed out in claim 9.

The protective member of the Plant reference is not a ballistic material but merely a device for absorbing the energy used in conjunction with other protective means such as those illustrated in Figs. 3 to 10 for making Active Protection Systems (page 6) sold to motorcyclists. These systems (Dianese) are unsuitable for ballistic purposes. A projectile can easily pass through the protective member disclosed by the Plant.

The use of the polymer in the form of a viscous or visco-elastic liquid, as recited in amended claim 1, results in improved ballistic performance of an anti-ballistic structure without impairing the flexibility of the composite material. This concept is not disclosed or made obvious by the Plant reference.

The Examiner has not asserted that the Tg of any of the materials disclosed in the prior art would inherently be the same as the Tg now recited in amended claim 1.The issue of the inherency of the properties of the prior art materials is not seen as particularly relevant when the existing data and descriptions of the prior art materials point to the fact that the prior art materials are not liquids as defined in amended claim 1 and the claims that depend from amended claim 1. It is believed than none of the materials that are disclosed in the cited references are viscous or visco-elastic polymers used as impregnating or wetting polymers that have the properties pointed out in amended claim 1. For these reasons, it is requested that this ground of rejection be withdrawn.

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An early and favorable action is earnestly solicited.

Respectfully Submitted,

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